

On a Periscopic Camera Obscura and Microscope. By William Hyde Wollaston, *M.D. Sec. R.S.* Read June 11, 1812. [*Phil. Trans.* 1812, p. 370.]

The same views which the author originally had of the periscopic construction of spectacles, naturally suggested to him a corresponding improvement in the camera obscura. But though it is evident that enlargement of the field of view, and some improvement in the distinctness of images obliquely situated, might be made by causing each part of a lens to be as nearly as may be at right angles to each pencil of rays that are to be collected to a focus, it was not clear to what extent this principle could be carried where the portion of lens is necessarily large, and consequently includes parts that may require a different form for preserving distinctness of other pencils of rays.

He has, accordingly, made trial of different forms of meniscus for this purpose, and describes the construction which appears to possess the greatest advantage with least detriment to the brilliancy and distinctness of objects centrally situated. The radii of curvature here preferred are in the proportion of 2 to 1.

A meniscus so formed is placed with its convex surface towards the plane of representation, and with its concavity toward the objects.

The aperture of the lens itself is made as large as the tools will conveniently admit, but the pencil of rays admitted to it in each direction is limited by a diaphragm, placed between it and the objects at about one eighth of its focal length from the lens, and having an opening about one tenth or one eleventh of the focal length in diameter.

By means of a camera thus constructed, the author observes, that objects as far as 30° removed from its centre are represented with considerable distinctness on the same plane as objects centrally situated.

The author also describes a microscope which he terms periscopic, because it is formed on the same principle of endeavouring to place all portions of a lens at right angles to the pencils transmitted through it in different directions. In the microscope this is effected by placing two plane convex lenses on opposite sides of the same aperture in a piece of thin metal interposed between their plane surfaces. The central opening being by that means nearly in the centre of curvature, no rays are suffered to pass to the eye but what are at right angles to both surfaces; and a field of view of at least 20° is obtained with a greater degree of illumination than can be admitted in the usual construction.

The paper is accompanied by a diagram for determining, by inspection, the various combinations of radii that will give to a meniscus any required focal length.